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DEFENSE SPENDING AND ECONOMIC GROWTH: SOME EMPIRICAL EVIDENCE FROM THE ARAB GULF REGION

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The present paper investigates the causal relationship between defense spending and economic growth in six Gulf countries for the period 1975–1998. I use Granger-causality test within a multivariate error-correction framework to explore the existence and direction of causality between these two variables. The empirical results indicate that neither growth nor defense can be considered exogenous and that the relationship between them cannot be generalized across countries. Two implications can be derived from these findings. One is the need for more studies, especially from developing countries, using time-series data. The other is that decisions on defense spending should be based on each country's socio-economic circumstances. Given the small sample size, however, caution is advised in considering the above results and their implications as final.

Keywords: Defense Spending; Economic Growth; Macro-economics; Defense Economics; Granger Causality; Theoretical Models; Empirical Models.

Classification: **JEL Codes: 01, 04**

I. INTRODUCTION

In recent years there has been a growing interest in the macroeconomic explanation of the relationship between defense spending and economic growth. It began with a cross-section study of 44 countries by Benoit (1978). In this study and, contrary to the author's expectations, he found that defense spending has a positive impact on economic growth. While Benoit assumed that the causality runs from defense spending to economic growth, he did not rule out the potential impact of economic growth on defense spending arguing that rich people may want to have a better insurance policy. Later studies have widened the scope of research by exploring whether or not such a relationship between the two variables exists in the first place, and if it does which of the two variables causes the other. Over the last twenty years, the research on the subject has advanced both theoretically and empirically. Theoretically, many researchers have tried to define the channels through which defense spending

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affects the rate of economic growth by concentrating on aggregate supply and aggregate demand effects.[1]

The supply-side effects concentrate on the opportunity cost of defense spending in terms of resources diverted away from more productive expenditures. This diversion can take different direct forms such as a reduction in private consumption, a diversion of resources from other productive uses such as education, housing and health services, a reduction in private and public savings and investment, and it can also take other indirect forms such as the pollution of the environment through nuclear testing, the strengthening of the military at the expense of the civil society, and the inefficient allocation of resources that characterizes the military establishment. These negative supply effects must, however, be weighed against the positive supply effects of defense spending that include, among others, human resource development, improved physical infrastructure (roads, airports, communications, *etc*), and the spread of technological know-how.

In addition to its supply-side effects, defense spending may have demand-side effects on economic growth. These effects can also be positive or negative depending on whether the economy is operating at full-employment or has some idle resources. If there is some unemployment, then an increase in defense spending may increase the rate of economic growth through its positive impact on aggregate demand. But if resources are fully utilized, then the increase in defense spending will be inflationary (Ram, 1995).

Similarly, there has been a growing empirical research on the relationship between defense spending and economic growth over the last twenty years. The methodology used in this area is diverse and some of the issues that were important in the econometric models used include: cross-section analysis for a group of countries versus a time-series analysis for a single country; single equations vs. simultaneous equations; using large samples or breaking the sample up according to economic and non-economic structural features; and testing for causality from defense spending or the other way around (Deger and Sen, 1995). The results from this empirical literature are, however, mixed and inconclusive, and there are at least four views on the existence and nature of the relationship between defense spending and economic growth (Ram, 1995 and Deger and Sen, 1995).

Benoit and others who argue that there is a positive causality running from defense spending to economic growth represent the first view. According to Benoit (1973, 1978), defense spending can lead to higher economic growth by raising aggregate demand. Assuming that developing countries have underutilized resources, the increase in aggregate demand will raise the level of investment and will generate more jobs which will, in turn result in higher rates of economic growth. Others have suggested that defense spending may lead to higher economic growth through its spin-off effect. This effect comes from the effect of defense spending on physical and social infrastructures such as roads, transportations, ports, and research and training, all of which are beneficial to civil society and conducive to economic growth (Deger, 1986). The second view is that defense spending is detrimental to economic growth. That is, so say the proponents, because if defense spending is financed by taxes or borrowing, then it will crowd-out private investment. Otherwise, it is a diversion of resources away from more productive government outlays such as education and health services (Deger and Smith, 1983; Lim, 1983; and Dunne and Vougas, 1999). Yet a third view about the relationship between defense spending and economic growth states that the causality between defense spending and economic growth is bi-directional, that is, defense spending causes economic growth and economic growth causes higher defense spending (Cappelen, *et al.*, 1985 and Kusi, 1994). Finally, there is a fourth view regarding the issue at hand and it states

[1]For an elaborate discussion of the a priori reasoning for the relationship between defense spending and economic growth see, for example, the paper by Rati Ram in, Payne and Sahu (1993).

that there is no relationship between defense spending and economic growth (Biswas and Ram (1986) and Grobar and Porter (1989)).

The lack of consensus on this topic can be attributed to a number of weaknesses in the existing literature. One is the excessive reliance on cross-sectional data, which led Chan (1985, p. 433) to conclude "we have probably reached a point of diminishing returns in relying on aggregate cross-sectional studies to inform us about the economic impact of defense spending". Then he goes on to conclude that: "Future research will profit more from discriminating diachronic studies of individual countries". Another weakness is that most of the literature's focus is on the experiences of the developed countries. Additional research on the impact of defense spending in developing countries will definitely enrich this literature and improve the policy implications derived from it. Yet, a third weakness in this literature is the use of variables that are not tested for stationarity (free of unit roots) and without taking into account the possibility of the existence of a long-run relationship between them (*i.e.* testing for co-integration). Both the use of non-stationary variables and the neglect of possible long-run relationships make regression results biased and unreliable (Granger and Newbold, 1974).

Thus, the objective of the present paper is to examine the relationship between defense spending and real economic growth in six Arab Gulf region countries including: Saudi Arabia; Iran; Kuwait; UAE; Oman; and Bahrain, taking into account the above mentioned gaps in the literature. In other words, by rectifying the above weakness in the methodology used in previous studies, the author hopes that, the results derived from the present paper will make a contribution, however small, toward a better understanding of the relationship between defense spending and economic growth in the Arab Gulf countries. Since the early 1970s, these countries have been allocating a large share of their oil revenues to defense spending. For example, during the years 1990-1999, their defense spending exceeded $278 billions at 1995 prices and exchange rate. Almost 60% of this total was spent by Saudi Arabia, followed by Kuwait (17.7%), Iran (8.6%), Oman (6.7), UAE (6.0%) and Bahrain (1%). Also, as a share of GDP in 1999, defense spending was 12.8% for Saudi Arabia; 9.3% for Kuwait; 3.3% for UAE; 12.8% for Oman; and 5.0% for Bahrain (SIPRI Yearbook, 2000). And according to Joffe (1994), the IMF have estimated that, in the early 1990s, the six GCC countries were among the 12 largest arms purchasers in the world devoting up to 13% of GDP to defense spending.

The rest of the paper is divided as follows. Section II specifies the model and describes the data. Section III presents and analyzes the results of the integration and cointegration tests. Section IV reports and discusses the results of the Granger causality test. Section V concludes.

II. METHODOLOGY AND DATA DESCRIPTION

Before proceeding to the analysis of the empirical results, a brief word about both the methodology used and data sources is in order.

Methodology

To examine the relationship between defense spending and economic growth in the six Gulf countries, I use a Granger causality test (Bishop, 1979). Beside economic growth and defense spending, the present model includes two additional variables that may affect our original variables and they are government expenditure and the degree of openness to trade of these economies. The importance of government expenditure as a possible determinant of

economic growth and defense spending stems from the fact that all the countries in our model are oil-based economies and since all oil revenues accrue to the governments, then one would think that an increase in oil revenues will enable these governments to raise their level of spending, including defense spending. The increase in government spending will also increase economic growth through its effect on the level of aggregate demand. Similarly, the openness to trade of an economy contributes to its economic growth by providing access to new and improved products, by enabling it to obtain advanced technology and by encouraging a more efficient use of resources (Pugel and Lindert, 2000). A Granger-causality test, however, requires that the variables used in a particular model be stationary, that is, their stochastic properties are time invariant. A number of studies have shown that the use of nonstationary variables results in spurious regressions and make diagnostic statistics (t, F, DW, and R-squared) both invalid and unreliable. [see for example, Granger and Newbold (1974), Phillips (1986), and Stock and Watson (1989)]. If differenced appropriately, however, a nonstationary variable can become stationary. In the present paper, I use two testing procedures for determining the proper order of differencing for the four variables in the model. They are the Augmented Dickey-Fuller (ADF) and the Perron-Phillips (PP) tests [see Enders (1995)]. Still, differencing a set of variables to achieve stationarity can dissipate long-run information if these variables have a long-run relationship (*i.e.* are cointegrated). Thus, if equations with stationary variables are estimated without regard to the cointegration between them, then, these equations are also inappropriate because they suffer from model misspecification (an omitted-variable bias). Again to deal with this problem, Engle and Granger (1987) show that a system of cointegrated variables can be represented by a dynamic error-correction model (ECM). To the model with the stationary variables, we add an error correction term (EC) as another regressor. This term is the lagged-once residuals that are generated from the cointegrating relationship between the variables in the model. Some researchers consider the error correction term as a representation of the long-run Granger causality.

Therefore, after converting the four variables to stationary time series, I test for possible cointegration between them. A widely used test of cointegration is the two-step procedure suggested by Engle and Granger (1987). However, this procedure is appropriate only for a bivariate model. Therefore, I employ the Johansen (1988) efficient maximum-likelihood approach which is more efficient test of cointegration in our multi-variate model.

Finally, defense spending as a proportion of GDP is taken as a proxy for the military variable (M), the ratio of government consumption to GDP is a measure of the role of government (GE), the degree of openness to trade is approximated by the ratio of exports to GDP (X), and the first differences of the log of GDP is used as an estimate of the growth rate (G).

Description of Data and Data Sources

The empirical results in this paper are derived from annual time series data on the four variables over the period, 1975–1998. This is the longest available sample on the countries at hand and as such the choice of the period is determined by the availability of data. The data on GDP, exports, and government spending come from different issues of the IMF *International Financial Statistics (IFS)*, while data on defense spending are from the Stockholm International Peace Research Institute (SIPRI) *Year Book on World Armaments and Disarmament*. I found SIPRI to be preferable to the other sources[2] because it covers more countries and for a longer period of time, it sources are diverse, its definition of defense spending is

[2]These sources include, among others, *Government Financial Statistics (GFS)* by the IMF, *World Military Expenditure and Arms Transfers* by *the* US Arms Control and Disarmament Agency (ACDA), and *the Military Balance* by the International Institute for Strategic Studies (IISS).

broad, and its estimates are in local currencies and US dollars and they are also in both current and constant prices. Still, one cannot assume that the data by SIPRI are problem-free because data on defense spending like all forms of data are subject to inaccuracies resulting from measurement errors, the conversion to other currencies, and manipulation for political and security reasons (Al-Faris, 1993). All these problems are pertinent to the countries in our sample, especially Iran which has been in a protracted war with Iraq for more than 10 years during the last two decades.

III. EMPIRICAL RESULTS

A. Unit Root and Cointegration Test Results

Our starting point is to test our variables for stationarity, using the ADF and PP procedures. Table 1 reports the results. It is clear that the four variables in the six countries have unit roots at their levels, but are stationary at first differences. Having established that the four variables in each country are stationary at first differences, the next step is to check if they are cointegrated, that is if they have a long-run relationship. The results from the Johansen test are reported in Table 2. They show that the null hypothesis of no cointegration between the variables of the model is rejected for all the countries in our sample on the basis of both the trace and maximal eigenvalue tests.[3]

This means that there is a long-run relationship between defense spending, economic growth, government spending, and the degree of openness to trade in all the countries in our sample. Accordingly, an error correction term should be added to the causality-test equations to capture this long-run relationship.

B. Granger-Causality Test Results

To test whether defense spending Granger-causes real economic growth, I estimate the following multi-variate error-correction model (ECM) for each country:

$$DG_t = \alpha_0 + \sum_{i=1}^{n1} \alpha_{1i}\, DG_{t-i} + \sum_{i=1}^{n2} \alpha_{2i}\, DM_{t-i} + \sum_{i=1}^{n3} \alpha_{3i}\, DGE_{t-i} + \sum_{i=1}^{n4} \alpha_{4i}\, DX_{t-i} + \lambda\, EC_{t-i} + e_t \tag{1}$$

Where the four variables are expressed in first differences (D) as, determined by the stationarity test. G denotes real gross domestic product, M denotes the ratio of defense spending to GDP, GE denotes government spending, X is the degree of openness, EC is the error-correction term taken from the multivariate cointegrating relationship, e is a white-noise error term, t denotes time in years, and the n's are the lag orders of the polynomials in α's. I use the Hendry General-to-Specific modeling strategy to determine the proper lag length on each independent variable (Gilbert, 1986). The null hypothesis that defense spending does not Granger-cause real economic growth is rejected if the coefficients on the distributed-lagged defense spending variables (α_{2i}'s) are found to be statistically significant as a group and/or the coefficient on the EC term is found to be statistically significant. As stated earlier, the significance of α_{2i} indicates short-run Granger-causality, while the significance of the λ indicates long-run Granger-causality between the two variables. Of course, if the two

[3]The results from the maximal test are available upon request from the author.

Table 1 Unit Root Test Results

Country/Variables	*ADF (L)*	*PP (L)*
Saudi Arabia		
A. Variables in Levels		
Real GDP (G)	−0.29(4)	−0.10(4)
Defense Spending (M)	−0.20(3)	−0.04(3)
Government Spending (GE)	−0.43(2)	−0.50(2)
Openness to Trade (X)	−0.06(2)	−0.07(2)
B. Variables in First Differences		
DG	−3.19*(3)	−10.84*(3)
DM	−3.22*(2)	−28.48*(2)
DGE	−2.46*(3)	−17.66**(3)
DX	−3.20*(2)	−21.75**(2)
Kuwait		
A. Variables in Levels		
Real GDP (G)	−1.67(2)	−9.53(2)
Defense Spending (M)	−1.62(3)	−6.32(3)
Government Spending (GE)	−0.98(2)	−1.40(2)
Openness to Trade (X)	−0.14(2)	−0.01(2)
B. Variables in First Differences		
DG	−3.07*(3)	−18.80*(3)
DM	−2.54*(3)	−12.87*(3)
DGE	−3.30*(2)	−23.46**(2)
DX	−3.20*(3)	−22.29**(3)
Bahrain		
A. Variables in Levels		
Real GDP (G)	−0.61(2)	−0.36(2)
Defense Spending (M)	−1.78(2)	−7.01(2)
Government Spending (GE)	−0.86(2)	−0.27(2)
Openness to Trade	−0.76(3)	−5.18(3)
B. Variables in First Differences		
DG	−2.94*(2)	−12.56*(2)
DM	−3.32*(4)	−11.00*(4)
DGE	−1.72*(2)	−17.37**(2)
DX	−1.47*(4)	−20.33**(4)
UAE		
A. Variables in Levels		
Real GDP (G)	−1.15(2)	−0.19(2)
Defense Spending (M)	−1.06(2)	−1.00(2)
Government Spending (GE)	−0.95(2)	−0.44(2)
Openness to Trade (X)	0.00(2)	−0.00(2)
B. Variables in First Differences		
DG	−1.89*(2)	−12.66*(2)
DM	−2.39*(3)	−6.30*(3)
DGE	−1.77*(3)	−14.87**(3)
DX	−2.66**(2)	−19.37**(2)
Oman		
A. Variables in Levels		
Real GDP (G)	−1.33(2)	−0.19(2)
Defense Spending (M)	−0.44(2)	−0.11(2)
Government Spending (GE)	−0.33(2)	−0.05(2)
Openness to Trade (X)	−1.27(2)	−2.93(2)
B. Variables in First Differences		
DG	−1.22*(3)	−6.21*(3)
DM	−1.96*(3)	−22.82*(3)
DGE	−3.41**(2)	−25.47**(2)
DX	−2.57**(2)	−17.21**(2)

Table 1 Unit Root Test Results (*continued*)

Country/Variables	*ADF (L)*	*PP (L)*
Iran		
A. Variables in Levels		
Real GDP (G)	−0.69(3)	−0.007(3)
Defense Spending (M)	−0.38(2)	−0.23(2)
Government Spending (GE)	−0.80(2)	−0.24(2)
Openness to Trade (X)	−0.46(2)	−0.14(2)
B. Variables in First Differences		
DG	−2.01*(2)	−15.82*(2)
DM	−2.13*(2)	−23.40*(2)
DGE	−1.99*(2)	−26.87**(2)
DX	−2.58**(2)	−17.06**(2)

All variables are in natural logs. ADF and PP are the augmented Dickey-Fuller and the Phillips-Perron tests, respectively. L is the optimal lag according to the Akaike Information Criteria (AIC). An * indicates rejection of the null hypothesis of non-stationarity at the 10% level of significance, and ** indicates rejection of the null hypothesis at the 5% level of significance.

variables were not cointegrated, the EC term will not appear in the above equation, in which case we test only for a possible short-run causality.

To test the reverse hypothesis that real economic growth does not Granger-cause defense spending, I estimate another equation similar to the first equation, except for using defense spending as the dependent variable. As such, the second equation is as follows:

$$DM_t = \beta_0 + \sum_{i=1}^{m1} \beta_{1i}\, DM_{t-i} + \sum_{i=1}^{m2} \beta_{2i}\, DG_{t-i} + \sum_{i=1}^{m3} \beta_{3i}\, DGE_{t-i} + \sum_{i=1}^{m4} \beta 4i\, DX_{t-i} + \phi\, EC_{t-1} + \mu_t \qquad (2)$$

As in equation (1), our interest is in the statistical significance of the group coefficients β_{2i}'s (short-run Granger-causality) and in the statistical significance of ϕ (long-run Granger-causality).[4]

The empirical results from equations (1) and (2) for the six countries are presented in Table 3.

The results show that the relationship between defense spending and economic growth is mixed. A closer look at these results will make this point clear. In Saudi Arabia, the causality is positive and runs from defense spending to economic growth. It is however, a long-run phenomenon, that is, defense spending fosters economic growth in the long run rather than in the short run. Also, government spending and openness to trade do not seem to be important determinants of defense spending or economic growth. By contrast, in Kuwait, defense spending leads to lower economic growth both in the short-run and in the long run. But, as in Saudi Arabia, defense spending and economic growth are influenced neither by government spending nor by the degree of openness to trade. The results for Bahrain indicate that defense spending leads to economic growth both in the short-run and in the long-run. Also, in the short-run, both government spending and openness to trade tend to induce higher economic growth while openness to trade alone leads to more defense spending. In the

[4]Because our objective in this paper is to explore the relationship between defense spending and economic growth and in order to make the analysis simple, only equations that explain M and G are estimated here to the exclusion of separate equations for GE and X.

Table 2 Cointegration Test Results

Country	*The Johansen (trace) Test*	
	Null Hypothesis	*Test Statistics*
Saudi Arabia		
	$r = 0$	61.79**
	$r \leq 1$	35.36
	$r \leq 2$	14.88
	$r \leq 3$	3.54
Kuwait		
	$r = 0$	52.50*
	$r \leq 1$	29.86
	$r \leq 2$	14.45
	$r \leq 3$	3.11
Bahrain		
	$r = 0$	68.92**
	$r \leq 1$	40.36
	$r \leq 2$	18.10
	$r \leq 3$	7.35
UAE		
	$r = 0$	111.70**
	$r \leq 1$	27.59
	$r \leq 2$	11.85
	$r \leq 3$	2.29
Oman		
	$r = 0$	76.86**
	$r \leq 1$	44.42
	$r \leq 2$	18.20
	$r \leq 3$	5.35
Iran		
	$r = 0$	56.20**
	$r \leq 1$	32.88
	$r \leq 2$	17.50
	$r \leq 3$	4.05

** Indicates rejection of the null hypothesis of no cointegration at the 5% level of significance. * Indicates rejection of the null hypothesis of no cointegration at the 10% level of significance. r denotes the number of cointegrating vectors.

UAE, there is a bi-directional causality between defense spending and economic growth. For while defense spending Granger-causes economic growth both in the short-run and in the long-run, economic growth induces greater defense spending only in the short-run. Here again, as in Bahrain, both government spending and openness to trade have a positive impact on economic growth. But unlike the case of Bahrain, it is openness to trade rather than government spending, that encourages defense spending. It is also clear from the same Table that in Iran the relationship between defense spending and economic growth is similar to that in Saudi Arabia because it runs from defense spending to economic growth but it is different since it carries a negative sign as in the case of Kuwait. And lastly, in Oman, the two variables do not seem to be related even though the degree of openness tends to lead to more defense spending.

The above results lead us to conclude that the relationship between defense spending and economic growth cannot be generalized across countries. This result accords with the findings of others (Chowdhury (1991), Landu (1993) and Kusi (1994)), who have concluded that defense spending depends on a number of factors including: the nature of the expendi-

Table 3 Granger-Causality Test Results for Arab Gulf Countries

Null Hypothesis	*F-Statistics*	
	Short-Run	*Long-Run*
Saudi Arabia		
A. Dependent Variable: Real Economic Growth (G)		
Defense Spending does not Granger-cause G	**1.00**	**−2.37***
Government Spending does not Granger-cause G	2.18	
Openness to Trade does not Granger-cause G	1.24	
B. Dependent Variable: Defense Spending (M)		
Economic Growth does not Granger-cause M	**0.35**	**−0.25**
Government Spending does not Granger-cause M	1.75	
Openness to Trade does not Granger-cause M	−0.11	
Kuwait		
A. Dependent Variable: Real Economic Growth (G)		
Defense Spending does not Granger-cause G	**8.9****	**−2.10****
Government Spending does not Granger-cause G	0.91	
Openness to Trade does not Granger-cause G	0.96	
B. Dependent Variable: Defense Spending (M)		
Economic Growth does not Granger-cause M	**0.92**	**−1.23**
Government Spending does not Granger-cause M	1.42	
Openness to Trade does not Granger-cause M	0.14	
Bahrain		
A. Dependent Variable: Real Economic Growth (G)		
Defense Spending does not Granger-cause G	**4.40****	**−1.97***
Government Spending does not Granger-cause G	6.97**	
Openness to Trade does not Granger-cause G	5.15**	
B. Dependent Variable: Defense Spending (M)		
Economic Growth does Granger-cause M	**1.20**	**−0.58**
Government Spending does not Granger-cause M	0.12	
Openness to Trade does not Granger-cause M	15.50**	
UAE		
A. Dependent Variable: Real Economic Growth (G)		
Defense Spending does not Granger-cause G	**3.94***	**−2.76****
Government Spending does not Granger-cause G	8.14**	
Openness to Trade does not Granger-cause G	9.08**	
B. Dependent Variable: Defense Spending (M)		
Economic Growth does not Granger-cause M	**4.25****	**−0.34**
Government Spending does not Granger-cause M	1.33	
Openness to Trade does not Granger-cause M	5.41**	
Oman		
A. Dependent Variable: Real Economic Growth (G)		
Defense Spending does not Granger-cause G	**0.12**	**−1.54**
Government Spending does not Granger-cause G	0.39	
Openness to Trade does not Granger-cause G	0.10	
B. Dependent Variable: Defense Spending (M)		
Economic Growth does not Granger-cause M	**0.47**	**−0.40**
Government Spending does not Granger-cause M	1.13	
Openness to Trade does not Granger-cause M	7.35**	
Iran		
A. Dependent Variable: Real Economic Growth (G)		
Defense Spending does not Granger-cause G	**0.07**	**−3.34****
Government Spending does not Granger-cause G	1.51	
Openness to Trade does not Granger-cause G	1.71	
B. Dependent Variable: Defense Spending (M)		
Economic Growth does not Granger-cause M	**1.91**	**−0.96**
Government Spending does not Granger-cause M	0.92	
Openness to Trade does not Granger-cause M	1.08	

** indicates rejection of the null hypothesis at the 5% level of significance and * indicates rejection at the 10% level of significance. The statistics in the short-run denote t-statistics if the independent variable is lagged once and F-statistics if it is lagged more than once. The long-run statistics are the t-statistics for the error correction term.

ture; the prevailing circumstances; and the concurrent government policies. Also in a recent survey of the empirical literature on the defense-growth relation over the last twenty years, Ram (1995) concludes that "By way of a summary of the substantive results, it is noted that the weight of the evidence suggests neither a positive nor a negative overall effect of defense outlays on growth" (p. 271).

IV. CONCLUSIONS

The objective of this paper has been to explore the existence and nature of the relationship between defense spending and economic growth. In contrast to much of the current literature, which focuses on the developed countries and uses cross-sectional data, the present paper examines the defense-growth causality issue using time series data from six Arab Gulf region countries. A major conclusion of this study is that the relationship between defense spending and economic growth cannot be generalized across countries. This conclusion has two implications. One is the need for more studies from other countries using time-series data. And the second is that decisions on military spending should be based on empirical growth circumstances of individual countries.

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